Comparison between MC and TB data for muon

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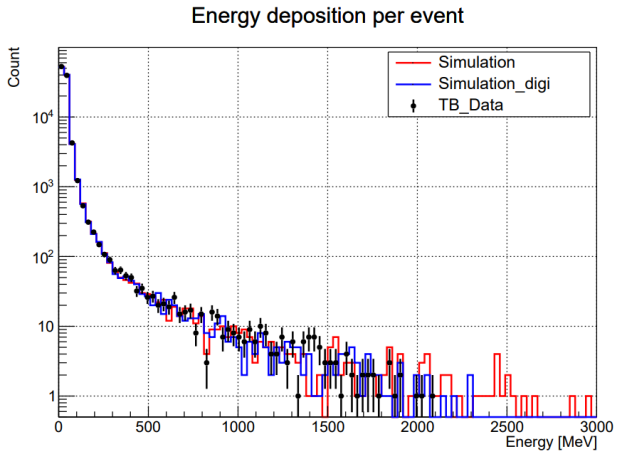
- Test beam sample: /cefs/higgs/shiyk/Beam_2022/DataBase/Calib/Particle/HCAL_alone/mu+/AHCAL_Run119_20221023_194647.root
- Simulation sample: /cefs/higgs/qibh/G4Simulation/Data/SimCalModule/run20230216_AHCAL_Data/mu+/BeamData_calo_mu+_160GeV.root

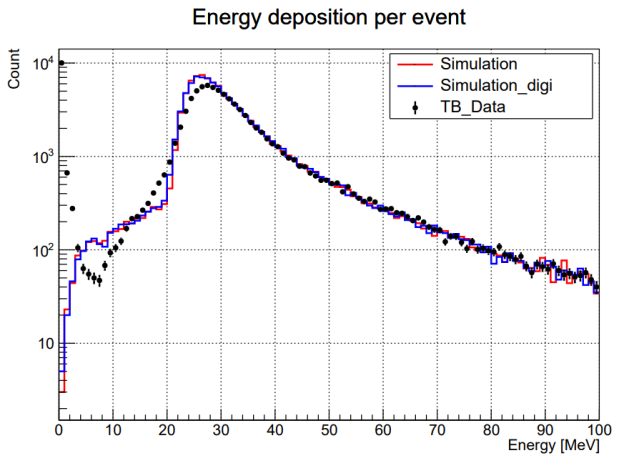
- Without event selection
- Events: 100000
- Energy cut: 0.3 MIP (1 MIP = 0.461MeV)
- The light leakage cell was muted in TB data

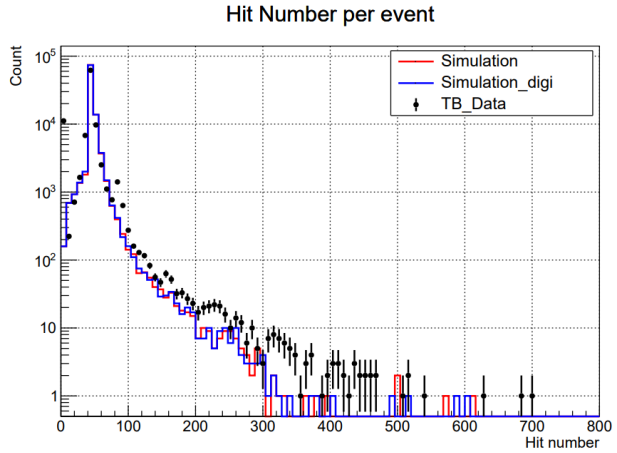
Conclusion:

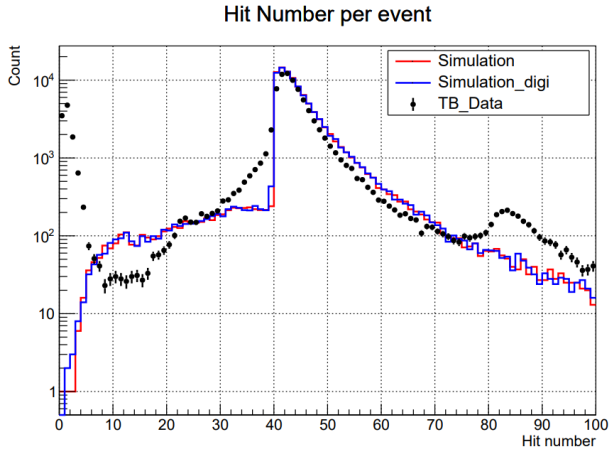
➢ TB data and MC are matched not well in event energy, event #hit and hit energy

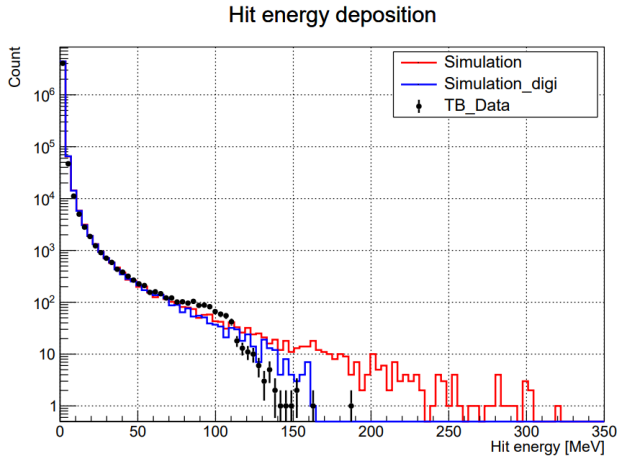
➢ TB data have many events with low energy and less #hit → event selection

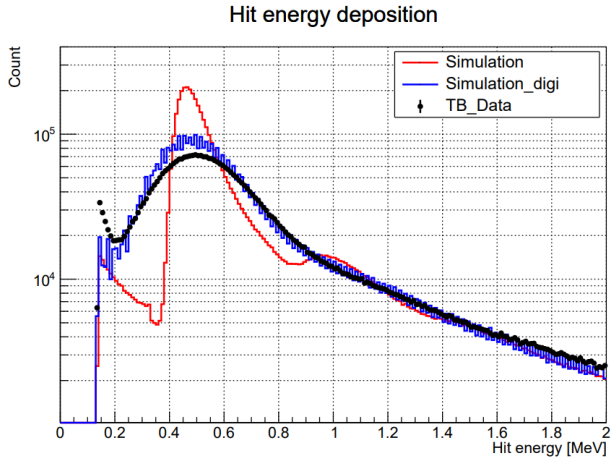


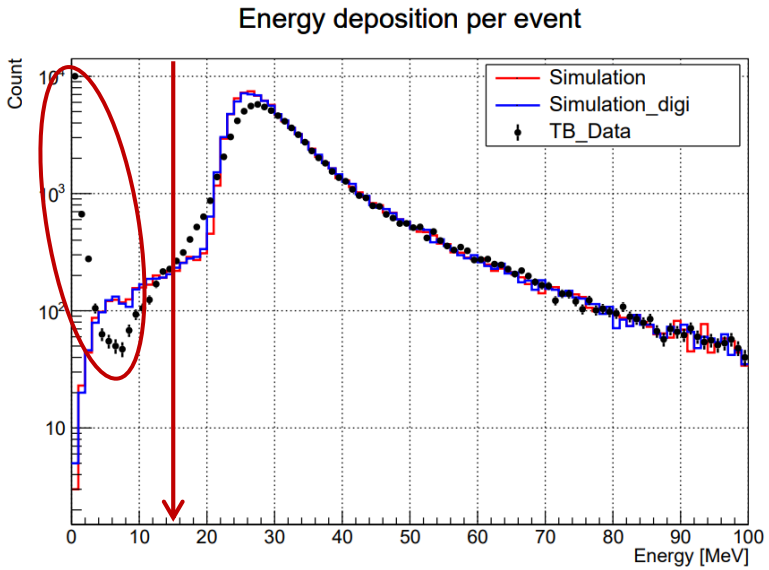


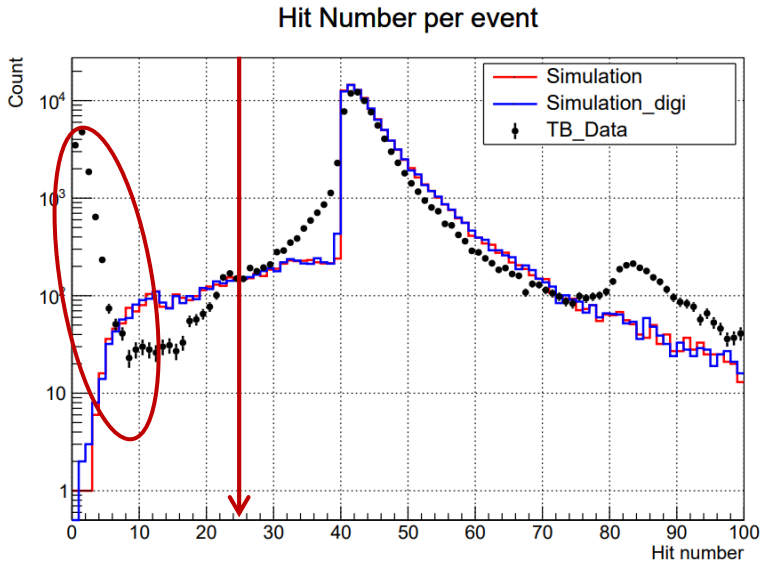


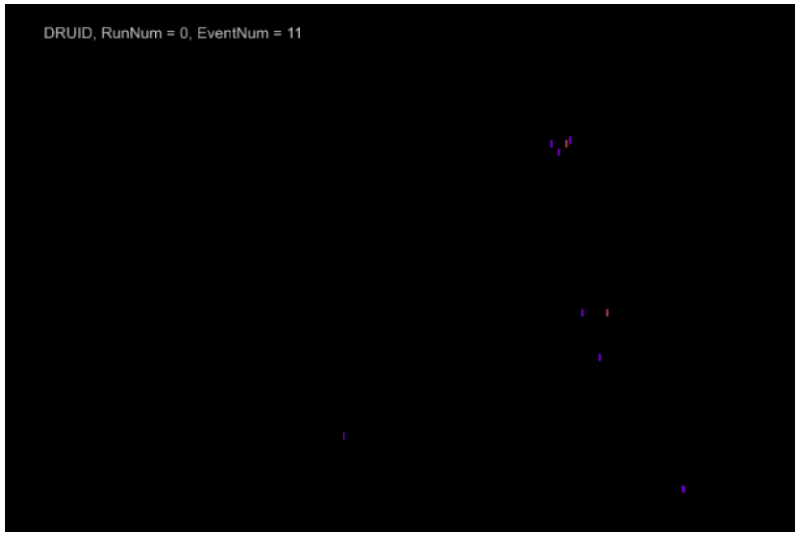


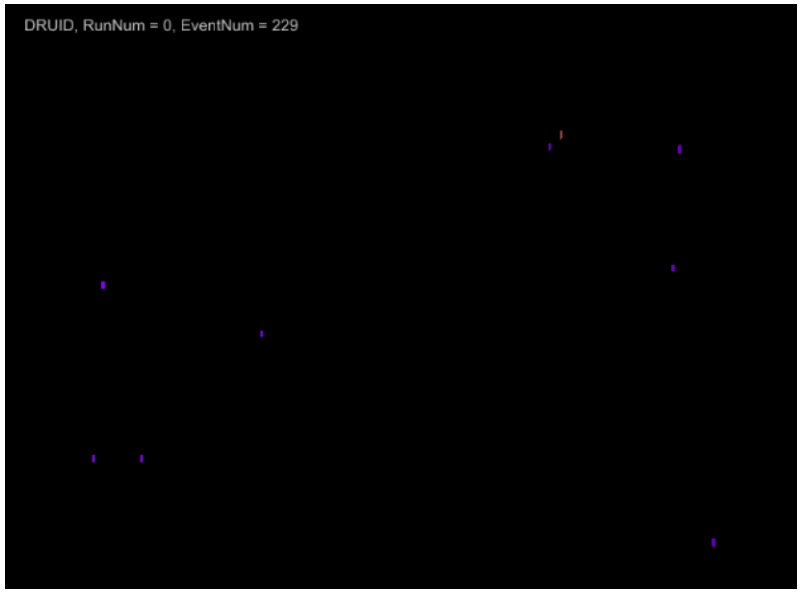










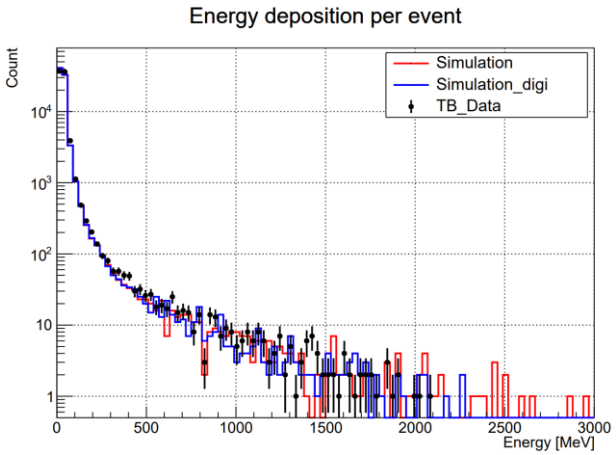


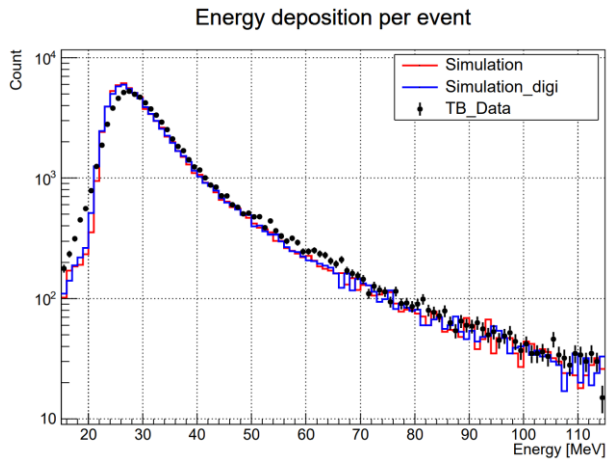
- Remove these noise events by event selection
  - Event energy deposition > 15 MeV
  - Event #hit > 25

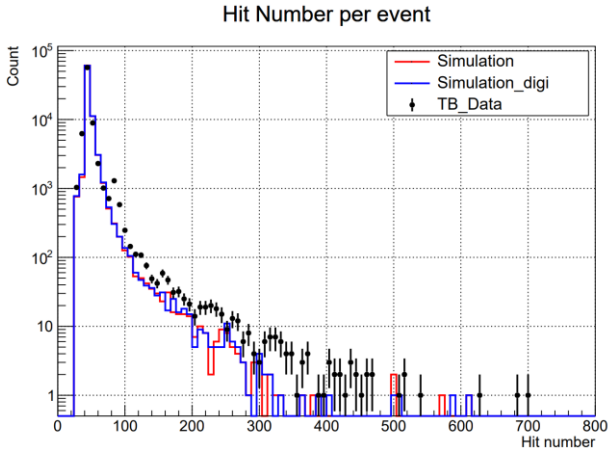
- With event selection:
  - Energy deposition per event > 15 MeV
  - #Hit per event > 25
- Events: 80000
- Energy cut: 0.3 MIP (1 MIP = 0.461MeV)
- The light leakage cell was muted in TB data

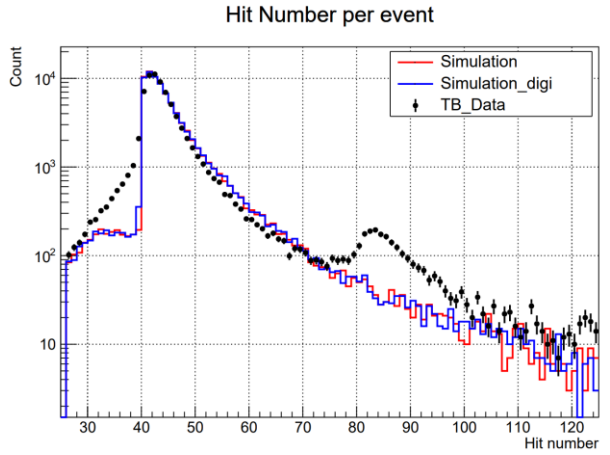
Conclusion:

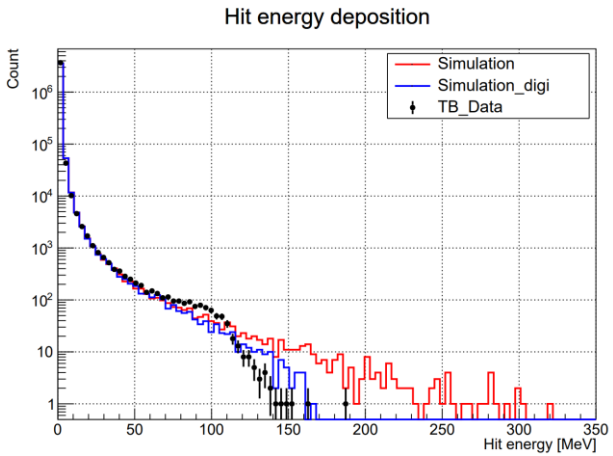
- TB data and MC are still matched not well in event energy, event #hit and hit energy
- The peaks of TB data are slightly larger than MC
- #Hit per event
  - TB data is larger than MC
  - TB data have two peaks, and the second peak position is double the first

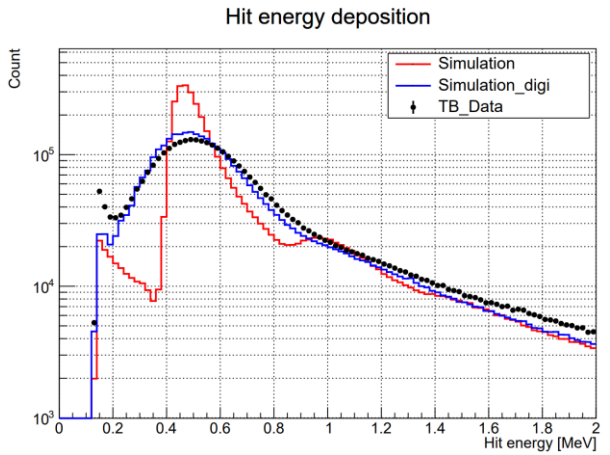




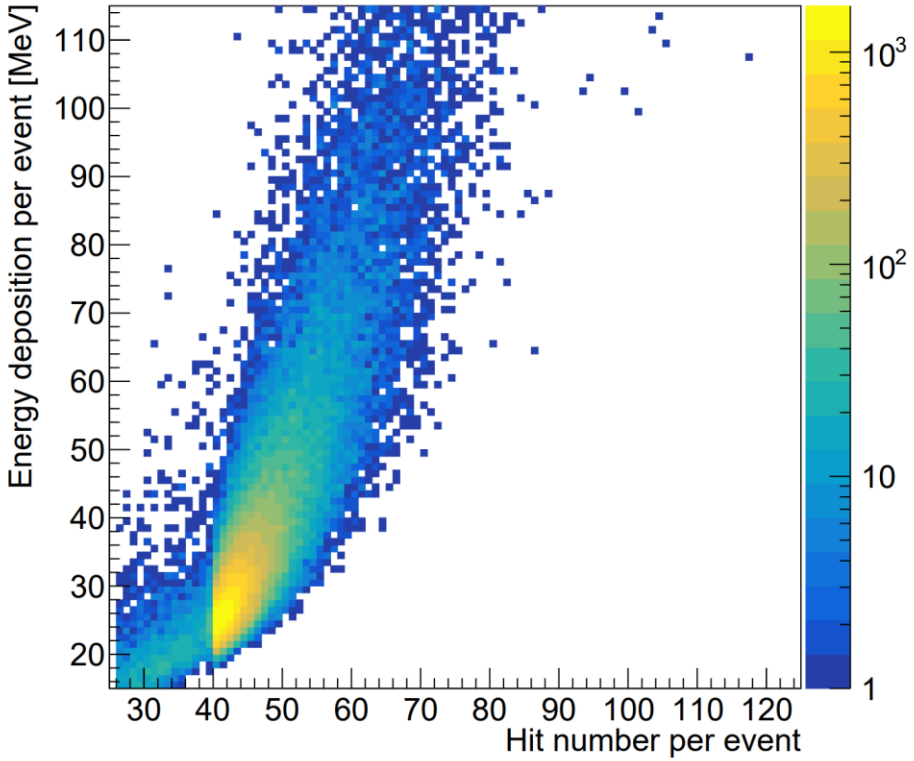




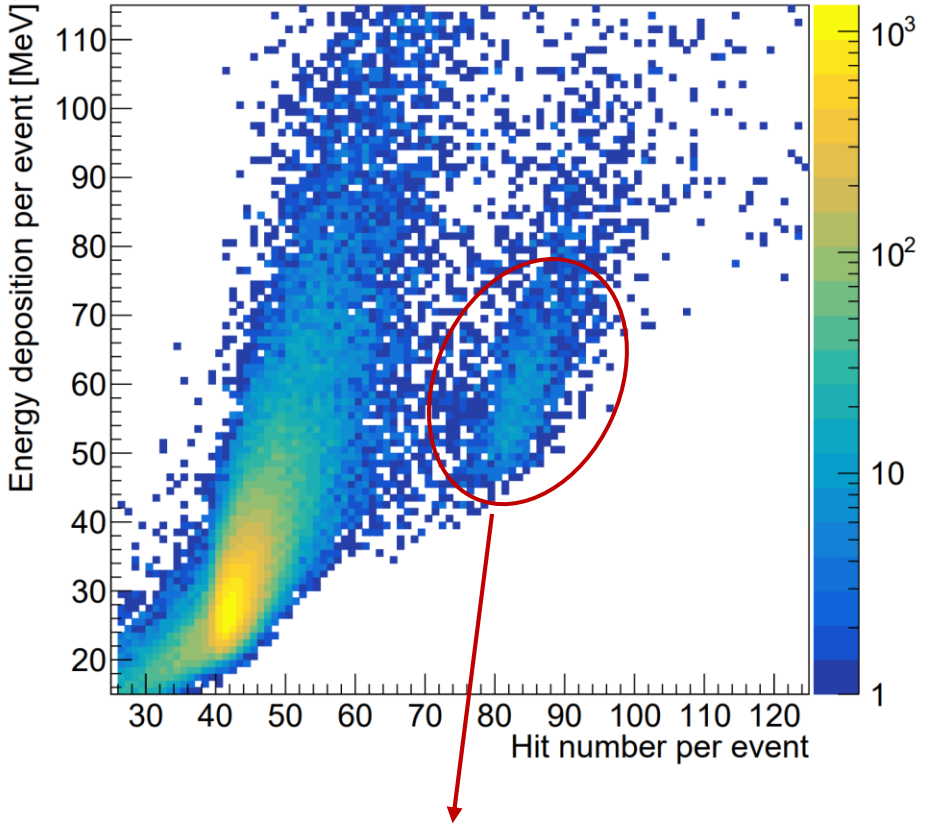




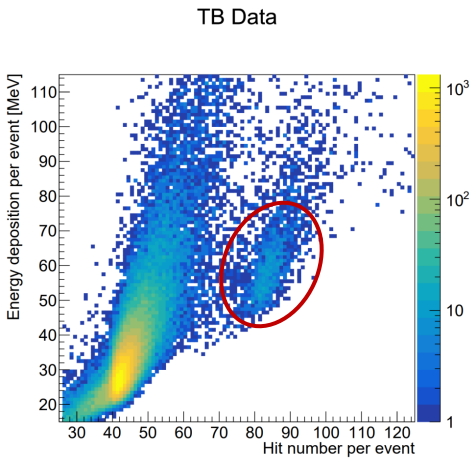
Simulation_digi

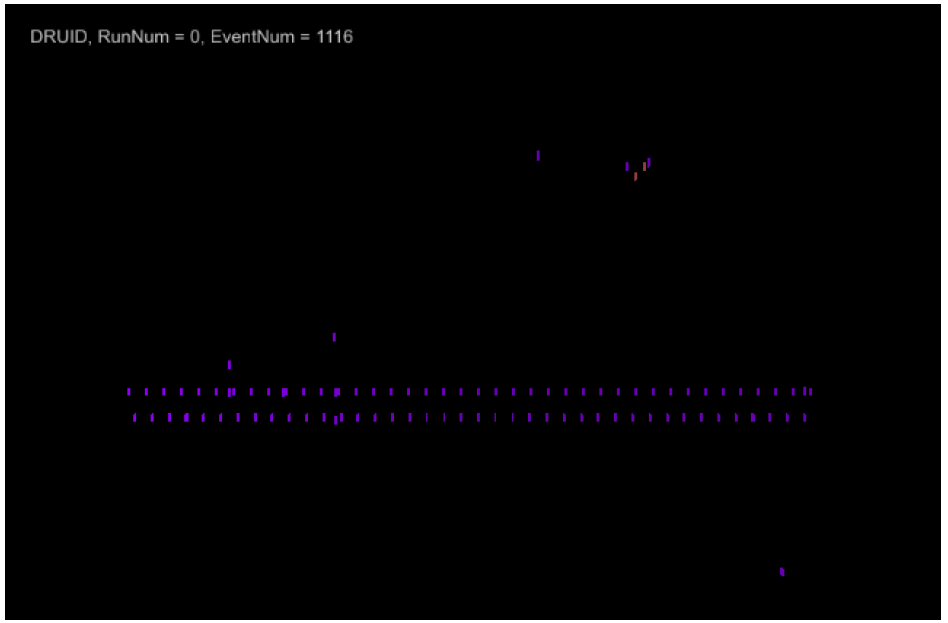


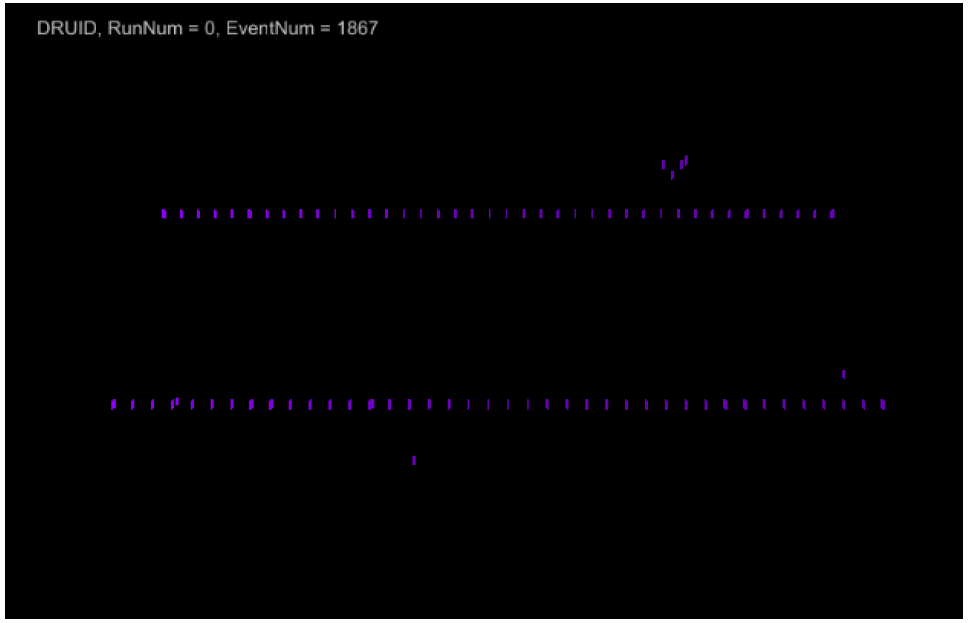
TB Data



Two-muon event?

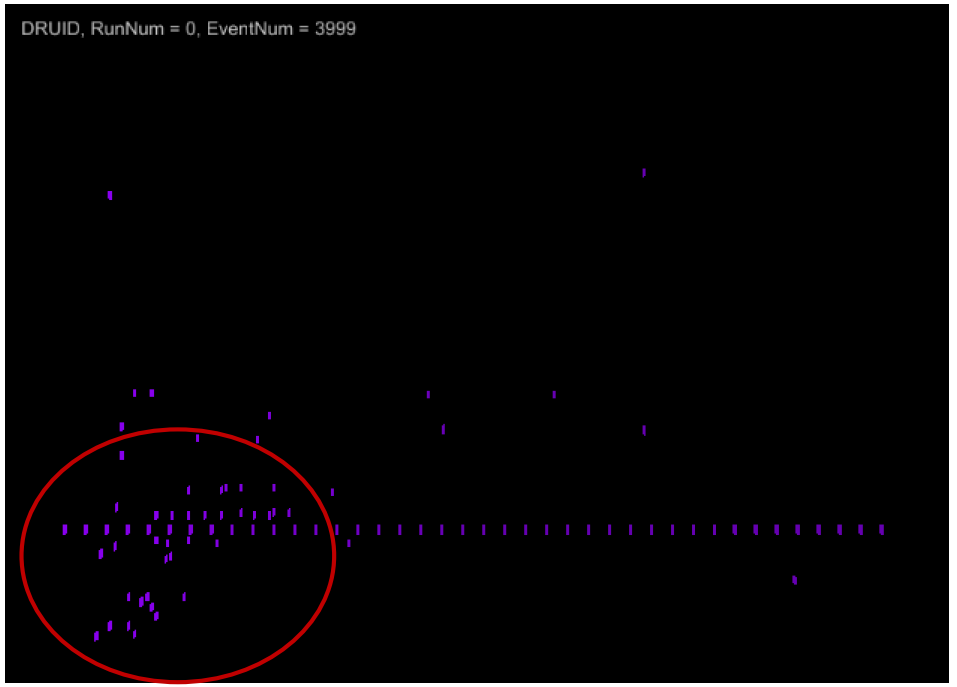






Event display

- Most of them are two-muon events
- Two muons may be separated by a wide distance
- Small part of them are one muon + ?

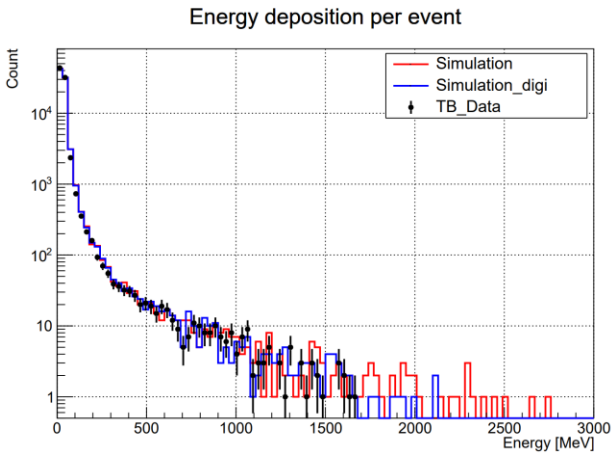


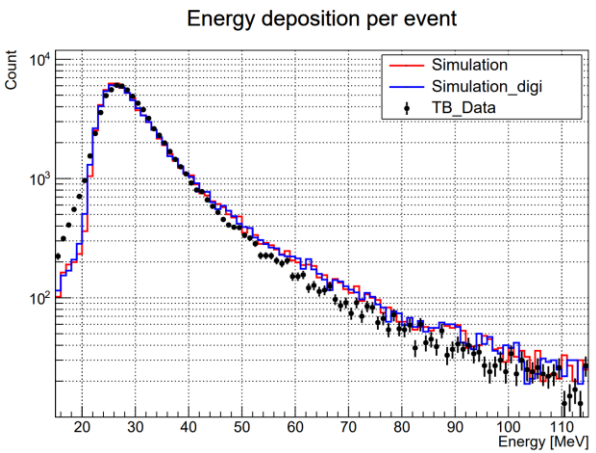
- With event selection:
  - Energy deposition per event > 15 MeV
  - #Hit per event > 25
- With hit selection:
  - Just select center 4 cells
- Events: 80000
- Energy cut: 0.3 MIP (1 MIP = 0.461MeV)
- The light leakage cell was muted in TB data

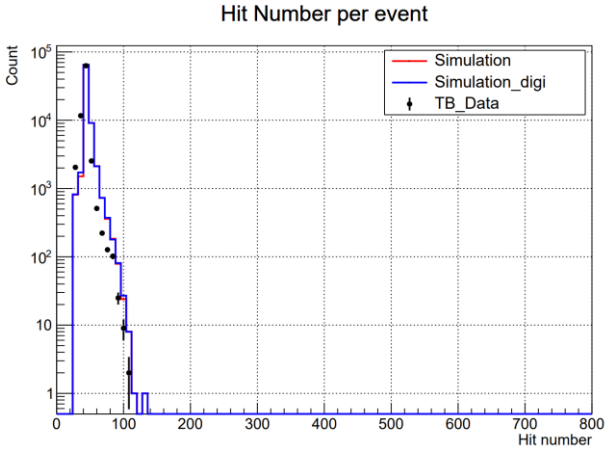
Conclusion:

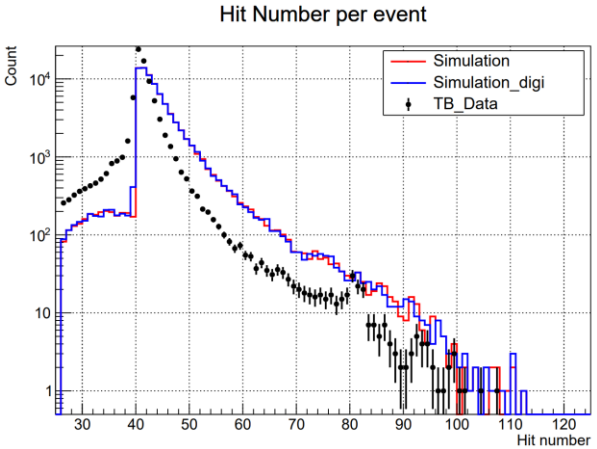
➢ Better consistence of peak position between TB data and MC in event energy, event #hit and hit energy

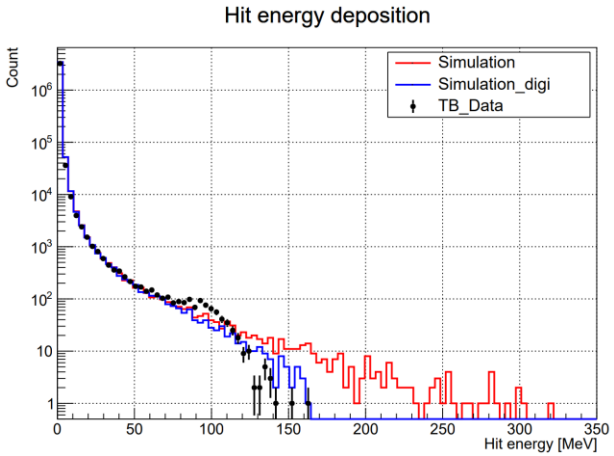
➢ Most of the two-muon events have been cut

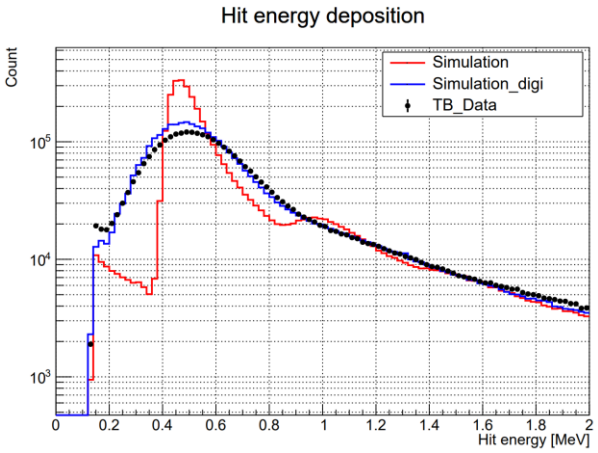




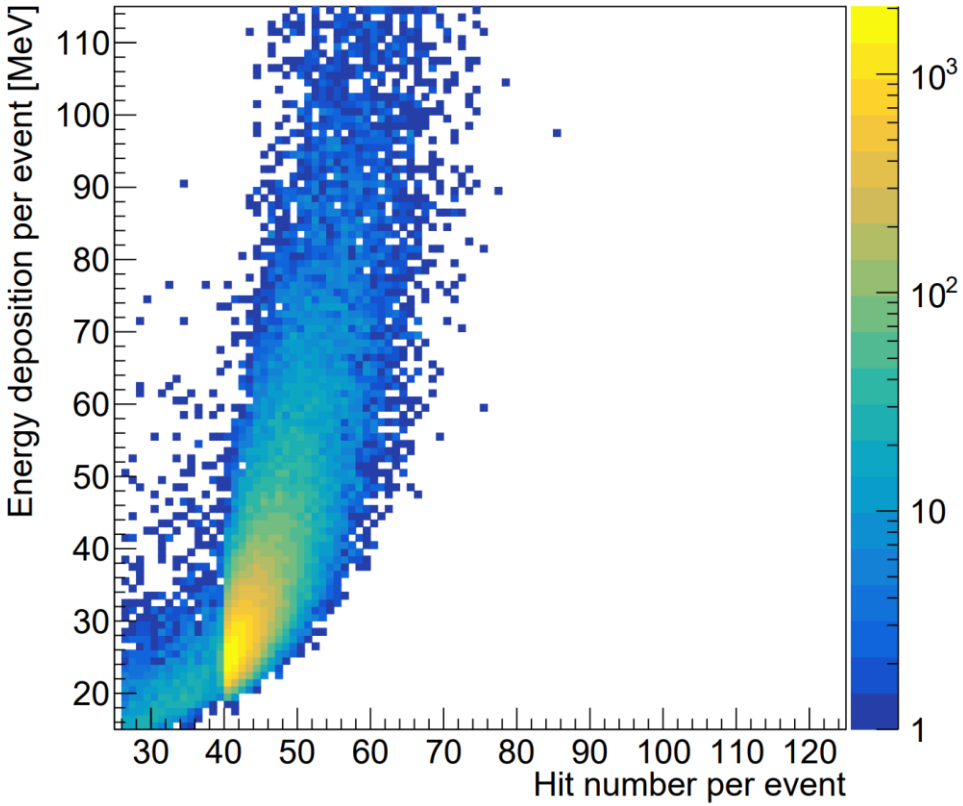




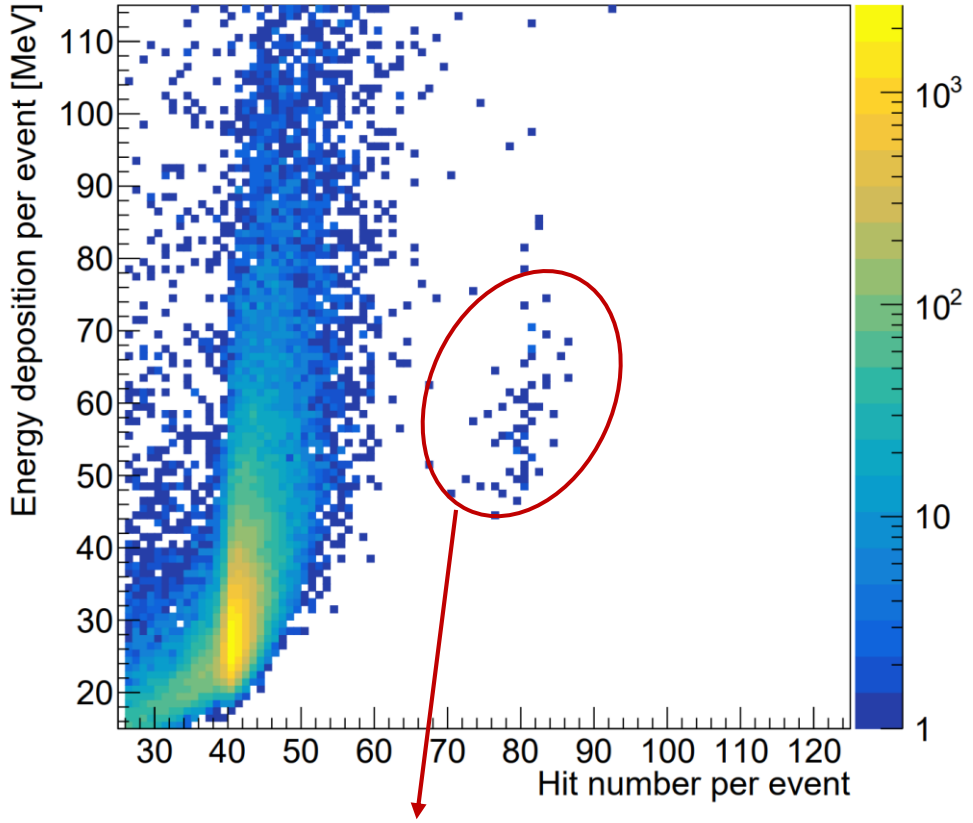




Simulation_digi



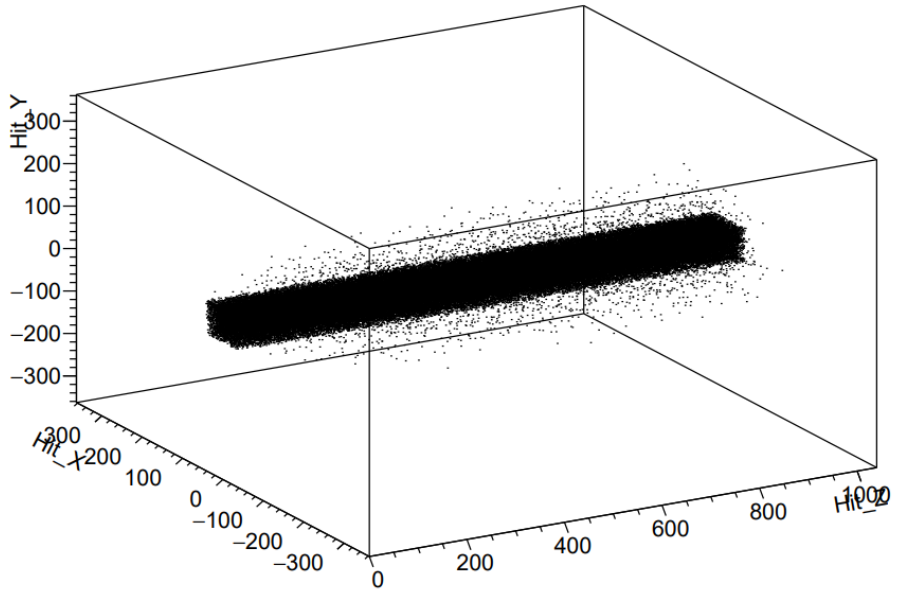
TB Data



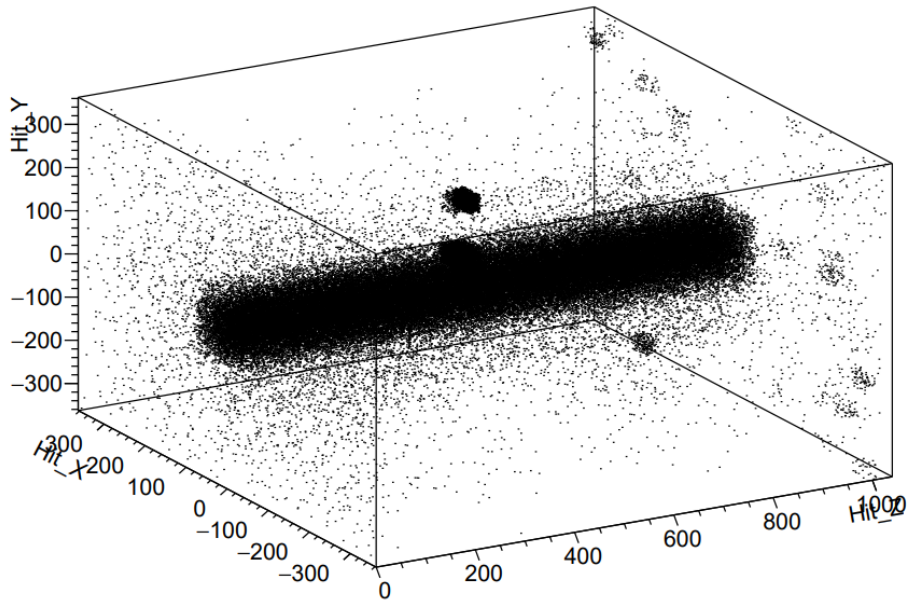
Most of the two-muon events have been cut

Backup

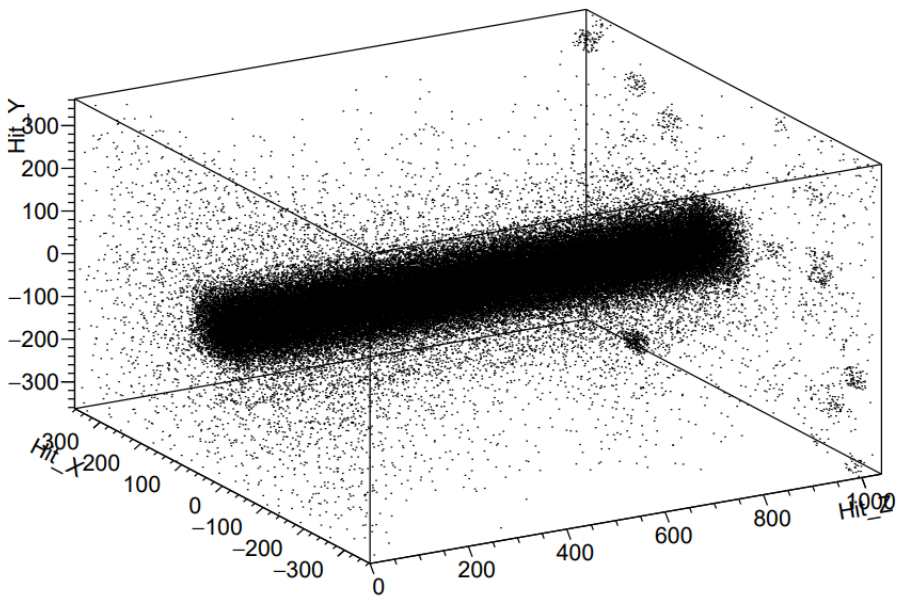
Simulation_0.3MIP



TB Data_noCut



TB Data_CellCut



TB Data_CellCut_0.3MIP